A.6.4 Astrobiology Science and Technology Instrument Development (ASTID)

1. Scope of Program

The Astrobiology Science and Technology Instrument Development (ASTID) program element requests proposals to develop instrumentation capabilities that will help meet Astrobiology science requirements on future space flight missions, as well as unique Astrobiology science objectives on Earth. Selected activities are expected to advance the development of scientific instruments or instrument components to the point where the instruments could be credibly proposed in response to future flight opportunity announcements. In addition, the development of laboratory instruments designed to significantly advance Astrobiology science will also be considered, although proposals to build flight-qualified hardware are not allowed for this program element.

1.1 Background

In the summer of 1998, NASA and the science community created a roadmap for Astrobiology that describes the scientific goals and objectives for this program, which is now available on the Astrobiology web site at http://astrobiology.arc.nasa.gov/roadmap. The instrumentation developed from research supported through this program element is meant to address two fundamental questions in Astrobiology, namely, "How does life begin and evolve?" and "Does life exist elsewhere in the Universe?" The specific objectives that could be addressed by new spacecraft instrumentation are, for example:

- To determine whether the atmosphere of the early Earth, hydrothermal systems, or exogenous matter were significant sources of organic matter;
- To search for evidence of ancient climates, extinct life, and potential habitats for extant life on Mars; and
- To determine the presence of chemical precursors and potential habitats for life in the outer Solar System.

This expected improvement to Astrobiology science and technology will further two broad objectives of the Office of Space Science. The first objective is to determine the general principles governing the organization of matter into living systems and the conditions required for the emergence and maintenance of life. The second is to chart the distribution of past and present life-sustaining environments and search for evidence of past and present life.

1.2 ASTID Goals for Flight Instruments and Technologies

To take advantage of the wide range of mission opportunities, Astrobiology requires the development of innovative technologies. Because of limited spacecraft accommodations, scientific instruments must be very small and robust, and have low power and telemetry bandwidth requirements. The mass, volume, and power constraints will be even more severe for instruments that would fly on so-called "scouts," by which is meant small multiple-copy landers for multiple sites that may be used in some of the planetary exploration programs. In all cases, instruments on spacecraft need to operate autonomously or allow teleoperation while conducting complex *in situ* sample analyses.

Successful instruments will have to operate in environments characterized by extremes of temperatures, pressures, dormant periods while in transit to other worlds, gravity, high-g landing impacts, vibration, and/or high radiation. Sensors already exist that range from fingernail to matchbook sizes, and a wide array of miniaturized chemical laboratories exist that can fit on a compact disk; however, relatively few are ready to be proposed successfully for space flight.

Major targets of Astrobiology interest include Mars, Europa, Titan, comets, Space Station, and Earth. ASTID program emphasis will be placed on proposals that are relevant to missions with the greatest potential of meeting Astrobiology goals for which instruments have not yet been selected. Furthermore, support can be provided for long lead-time definition studies, for innovative approaches that may provide entirely new classes of instruments, for the development of new enabling technologies for missions further in the future, and/or for development studies that may advance the technology for a wide range of instrumentation applications. It is anticipated that to develop potential space flight instruments, some approaches will require novel instrument concepts while other approaches will focus on reductions in mass, volume, power requirements, and/or costs of existing technologies. NASA also recognizes that some approaches may require field testing to improve instrument utility and robustness.

Although proposals in all areas relevant to Astrobiology goals and objectives will be considered for the ASTID program, a particular need in the following areas is recognized:

- The handling of samples collected for Astrobiological objectives,
- *In situ* detection of possible biomarkers such as isotopic and organic measurements, and
- Development of novel access technologies such as drilling into rock or deep drilling into the subsurface – bedrock, soil, or ice.

ASTID proposals are sought at three general levels: (i) feasibility study and instrument definition (i.e., proof of concept), (ii) instrument development and definition (i.e., the bread board stage), and (iii) development of instruments to the point where they may be proposed in response to future announcements of flight opportunities (the brass board stage). Proposals to define or develop one or more instrument components, rather than whole instruments, are allowed, particularly for immature or very complex new instruments. However, at least one or more likely scenarios for possible follow-on instrument development activities must be described in the case of component-only proposals. Scientific objectives of proposed instruments or components must be discussed in the proposal, and proposers are encouraged to relate their proposals as closely as possible to future missions of interest to the Astrobiology Program and demonstrate how their technology addresses their goals and objectives.

1.3 Examples of Future Missions

Proposals for long-lead time definition studies, novel instrument concepts, and innovative approaches leading to new instrument classes that could be relevant to one or several

missions will be considered. The following are examples of some, but not all, missions of interest to the Astrobiology Program:

Comet Missions. The possibility exists that comets may have contributed critical amounts or specific prebiotic chemicals that may have been necessary for life on Earth and perhaps elsewhere in the Solar System and also may have facilitated creation of the Earth's oceans. Therefore, proposals for instrument development for future missions to comets may include in situ surface chemical analysis to determine and characterize the organic composition of gas, ice particles, and dust; sample return capabilities; and concepts for sampling the comet nucleus.

Mars Surveyor Missions. The Mars Surveyor missions include orbiters and landers using small to medium sized spacecraft and launch opportunity windows that occur approximately every 26 months. The Mars Global Surveyor is currently in orbit, the 2001 Mars Odyssey orbiter will be launched in April, and instruments for the potential Mars Surveyor 2003 missions have already been determined. Therefore, only instrument development proposals for Mars missions beyond the Mars 2003 mission are appropriate through this ASTID program element. Examples of relevant proposals include, but are not limited to the development of:

- instrumentation capable of *in situ* isotopic measurement;
- microscale *in situ* technologies for detection and characterization of organic compounds;
- semiautonomous, deep, aseptic drilling and measurement systems to explore the subsurface and search for water;
- improved field analysis of "trace" or biomarker gases and biologically important solutes (e.g., nutrients), and
- physical/chemical factors that might be an indication of life.

Outer Solar System Missions. Possible missions to Europa include the Europa Orbiter, Europa Lander, Europa Ocean Observer, and Europa Lander Network. Instruments have already been selected for the Europa Orbiter. Instrument development proposals for the Europa Ocean Observer and Europa Landers are appropriate under this ASTID program element, for example:

- miniaturized *in situ* robotics and other instruments for icy bodies, including chemical and exobiological analyses;
- sample targeting, acquisition, and handling, including sampling of the dark (linea, etc.) surface features;
- orbital flight instruments to determine the inventory of organic compounds and biogenic elements on Europa's surface; and
- for the Europa Ocean Observer, which might include a penetrator for melting through the ice to reach the purported subsurface ocean, a “hydrobot” that could then be released to explore the ocean in search of biomarkers as possible evidence of life, characterization of the water column, and subsurface sediments.

The Cassini mission, which approaches Saturn in 2004, will lay the groundwork for any possible future Titan missions, including the planned Titan Biologic Explorer. Therefore,

proposals are appropriate for instruments to search for and identify more complex organic molecules, for Titan atmospheric characterization, for characterization of the formation processes and products related to Titan's organic haze, and surface exploration.

1.4 Nonflight ASTID Goals

Although the focus of the ASTID program is development of scientific instruments for future flight opportunities, consideration will also be given to proposals for development of ground based laboratory or field instrumentation important to the goals and objectives of the Astrobiology program. Of particular interest will be instrumentation that would potentially enable new research capabilities for Astrobiology, such as the ability to measure novel biomarkers. Finally, instrument development proposals not explicitly mentioned above may be appropriate under this program element provided they address the goals and objectives of the Astrobiology Program.

2. Programmatic Information

2.1 Program Overlap

Currently, the Planetary Instrument Definition and Development Program (PIDDP, Appendix A.6.2 in this NRA), also supports some instrument development. However, instrumentation focused primarily on Astrobiology should be submitted to this ASTID program, whereas planetary instrumentation development not focused on Astrobiology should be submitted to PIDDP. NASA reserves the right to resolve any overlap of proposals submitted to PIDDP and ASTID program at the programmatic level at the time of selections. Proposers should be aware that each of these programs has different constraints and proposals appropriate to one may not be appropriate to the other. For instance, the ASTID program will consider proposals from a broader timeframe than PIDDP, as well as laboratory instrumentation.

2.2 Availability of Funds and Size of Awards

Pending the final approval of NASA's Fiscal Year 2002 budget, up to one third of the program's budget ($2M) may be available for support of selections for the ASTID program. Awards are expected to range from $30K to $300K per year, for a maximum of three years (also see Section 2.3 below).

2.3 Periods of Performance for Proposals

Although proposals of up to three years may be submitted, NASA anticipates selecting a mix of one and two year proposals in order to allow about one third of the ASTID program to be open for competition in every subsequent year.

2.4 Proposal Preparation and Submission Information

IMPORTANT INFORMATION

As discussed in the *Summary of Solicitation* of this NRA, the Office of Space Science (OSS) is now using a single, unified set of instructions for the submission of proposals. This material is contained in the document entitled *OSS Guidebook for Proposers Responding to NASA Research Announcement – 2001* (or "*OSS Guidebook – 2001*" for short) that is accessible by opening "Research Opportunities and Data" from the menu at URL http://spacescience.nasa.gov, or directly at URL http://spacescience.nasa.gov/research/ossguidebook/. This NRA's *Summary of Solicitation* also contains the schedule and instructions for the electronic submission of a Notice of Intent (NOI) to propose and a proposal's *Cover Page/Proposal Summary*, for electronic access to the required *Budget Summary* form, and the mailing address for the submission of a proposal.

Questions about this program may be directed to the Discipline Scientist:

Dr. Michael A. Meyer
Research Program Management Division
Code SR
Office of Space Science
National Aeronautics and Space
Administration
Washington, DC 20546-0001
Phone: (202) 358-0307
E-mail: michael.meyer@hq.nasa.gov

OMB Approval No. 2700-0087

RESEARCH OPPORTUNITIES IN SPACE SCIENCE - 2001
(ROSS-2001)

NASA Research Announcement
Soliciting Basic Research Proposals

NRA 01-OSS-01
Issued: January 26, 2001

Proposals Due
Starting April 6, 2001,
and Ending November 9, 2001

Office of Space Science
National Aeronautics and Space Administration
Washington, DC 20546-0001

RESEARCH OPPORTUNITIES IN SPACE SCIENCE - 2001
(ROSS-2001)

SUMMARY OF SOLICITATION

• INTRODUCTION AND GENERAL POLICIES

The stated mission of the Space Science Enterprise of the National Aeronautics and Space Administration (NASA) is to solve the mysteries of the universe, to explore the solar system, to discover planets around other stars, and to search for life beyond Earth. To carry out this mission, NASA's Office of Space Science (OSS) sponsors a broad range of research programs relevant to its four Science Themes, which are defined as:

- *Astronomical Search for Origins and Planetary Systems* (ASO) that addresses the origins of galaxies, stars, proto-planetary and extra-solar planetary systems, Earth-like planets, and the origin of life;
- *Solar System Exploration* (abbreviated as ESS) that seeks to understand all aspects of our Solar System, including the planets, satellites, small bodies, and solar system materials, and the search for possible habitats of life beyond Earth;
- *Structure and Evolution of the Universe* (SEU) that involves the study of cosmology, the large scale structure of the universe, the evolution of stars and galaxies, including the Milky Way and objects with extreme physical conditions, and an examination of the ultimate limits of gravity and energy in the Universe; and
- *The Sun-Earth Connection* (SEC) that concerns the Sun as a typical star and as the controlling agent of the space environment of the Solar System, especially the Earth.

Stated informally, these four themes seek to answer four fundamental questions, "How did the Universe begin and evolve?" "Where did we come from?" "Where are we going?" and "Are we alone?" Further information about these themes as well as access to the most recent Strategic Plans (as of late 2000) for both NASA and OSS may be found through the OSS homepage on the World Wide Web at http://spacescience.nasa.gov . In addition, this NRA may be found through the menu listings "*Research Opportunities and Data/OPEN Opportunities*" at this same Web site.

OSS pursues these fundamental science themes using a wide variety of both space flight programs and investigations in basic science and technology. This current NASA Research Announcement (NRA) ROSS-2001 solicits proposals for Supporting Research and Technology (SR&T) investigations that seek to understand naturally occurring space phenomena and space science-related technologies across a full range of science subdisciplines relevant to OSS interests. These program elements are listed in the index to Appendix A at the

end of this Summary of Solicitation. Table 1 lists these program elements in the order of their respective due dates for the submission of proposals, while Table 2 lists them in according to their order shown in Appendix A. As a guide to their relationships, Tables 1 and 2 also cross references these program elements to the OSS Science Themes as noted above. Appendix A contains detailed descriptions of each element, and questions about each may be directed to their respective Discipline Scientists who are identified in the section entitled "Programmatic Information" that concludes the description of each program element.

Beginning with the ROSS NRA issued in February 2000 (NRA 00-OSS-01), the program elements offered through this series of solicitations have been grouped into nine "clusters" as indicated in the Table of Contents of Appendix A at the end of this Summary of Solicitation. It is a goal to group the due dates for proposals for the program elements within each cluster closely together in time to allow for the possibility of the reallocation of funding within a cluster once all its related proposals are reviewed. In addition, recommendations from a comparative review of all clusters in mid-2001 will be used to help determine the cluster structure and content, as well as funding allocations for Fiscal Year's 2002-2004 (October 1, 2001, through September 30, 2003). Questions about this evolving approach to the structure and review of the OSS SR&T program may be sent to:

Dr. Guenter R. Riegler
Director
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington, DC 20546-0001
Telephone: 202-358-1588
E-mail: guenter.riegler@hq.nasa.gov
Facsimile: 202-358-3097

Although Tables 1 and 2 effectively cross-references these newly defined clusters to many of the traditional ROSS Program Elements and the four OSS Science Themes, the section entitled "INTRODUCTION AND OVERVIEW" of Appendix A also provides additional narrative material that expands on these relationships. Therefore, anyone interested in applying to this NRA is urged to read the relevant parts of this introductory section to Appendix A for a full understanding of whether their research interests are relevant to NASA OSS interests, and, if so, to which cluster and program element their proposal should be submitted. It is especially important to note that the overall objective of each of these program elements to contribute as effectively and directly as possible to the achievement of OSS strategic goals. Therefore, priority for selection will be given to those proposals that most clearly demonstrate the potential for making such contribution (see also the discussion of the evaluation criteria below).

Recommendations for funding for the proposals submitted to this NRA will be based on the peer evaluation of each proposal's intrinsic merit, its relevance to NASA's objectives, and its cost. For the purposes of this NRA: (i) by intrinsic merit is meant the proposal's science and technical merits, the capabilities of the proposing institution, the qualifications of the proposing personnel, and the overall standing of the proposal among similar proposals and/or evaluation against the state-of-the-art; (ii) by relevance to NASA's objectives is meant the proposal's relevance to the objectives of the OSS science program element as described in this NRA to which the proposal is submitted; and (iii) by cost is meant the reasonableness and realism of the proposal's requested budget, in addition to its size. In all cases, the Government's obligation to make awards is contingent upon the availability of appropriated funds from which payment can be made and upon the receipt of proposals in response to this NRA that NASA determines are acceptable for award.

Participation in this program is open to all categories of U.S. and non-U.S. organizations, including educational institutions, industry, nonprofit institutions, NASA Centers, and other Government agencies. Historically Black Colleges and Universities (HBCU's), other minority educational institutions, and small businesses and organizations owned and controlled by socially and economically disadvantaged individuals or women are particularly encouraged to apply. Participation by non-U.S. organizations in this program is encouraged subject to NASA's policy of no-exchange-of-funds (see further information in the "*OSS Guidebook for Proposers…*" discussed below).

• NEW INSTRUCTIONS FOR PREPARATION/SUBMISSION OF PROPOSALS

Starting in 1998, the Office of Space Science began to use a single, unified set of instructions for the submission of proposals for almost all of its NRA's that were incorporated into each NRA. Such standardization has proven to be of significant value to NASA to help ensure the uniform handling and processing of submitted proposals, as well as to researchers interested in responding to multiple program elements within the ROSS NRA's, or even different OSS NRA's. However, starting with this ROSS-2001 NRA, these proposal policies and procedures, as well as those for NASA's review and selection of proposals for funding, are now described in a separate document entitled "*Office of Space Science (OSS) Guidebook for Proposers Responding to NASA Research Announcement – January 2001*" (abbreviated as "*OSS Guidebook – 2001*") that is accessible by opening "*Research Opportunities and Data*" from the menu at the World Wide Web URL http://spacescience.nasa.gov, or may be directly accessed at URL http://spacescience.nasa.gov/research/ossguidebook/.

By reference, this *OSS Guidebook – 2001* is hereby incorporated into this ROSS–2001 NRA, and proposers to this NRA are responsible for understanding and complying with its procedures before preparing and submitting their proposals. In particular, its Chapter 2 ("Proposal Preparation and Organization") and Chapter 3 ("Proposal Submission Procedures") largely

replace the contents of "Chapter C" in most OSS NRA's issued during the previous three years. Proposers familiar with these past OSS NRA's will find that these instructions are essentially unchanged from those introduced starting in 1998. Also, note that the NASA-required proposal *Budget Summary* form is now available electronically through the Web site designated for the *Cover Page/Proposal Summary* (see Summary Information below) for printing in hard copy for submission with the hard copies of the proposal. The other chapters and appendices of this *OSS Guidebook – 2001* provide supplemental information about the entire NRA process, including NASA policies for the solicitation of proposals (including those involving non-U.S. participation), guidelines for writing complete and effective proposals, the NASA policies and procedures for the proposal review and selection processes, and for issuing and managing the awards to the institutions that submitted selected proposals, and Frequently Asked Questions (FAQ's) about a variety of proposal and award processes and procedures.

Comments and suggestions of any nature about this *OSS Guidebook – 2001* are encouraged and welcomed and may be directed at any time to Dr. David Bohlin, Research Program Management Division, Code SR, Office of Space Science, NASA Headquarters, Washington, DC 20546-0001; telephone: (202) 358-0880; E-mail: david.bohlin@hq.nasa.gov (if submitted by E-mail, use "Proposer's Guidebook" as the Subject of the message).

The World Wide Web site for submitting both a Notice of Intent (NOI) to propose and a proposal's *Cover Page/Proposal Summary* is given in the Summary Information below (Chapters 2 and 3 of the *OSS Guidebook – 2001* as discussed above contains detailed information about these two items). This Web site will be open for the submission of NOI's for any given program element in this NRA for typically 30 days, starting about 90 days before the proposal due date, and the site will be open for the submission of the other required proposal materials starting about 45 days before the proposal due date (see Tables 1 and 2 below for all schedules). A point of contact for assistance in accessing and/or using this Web site is given in the Summary Information below.

- OSS EDUCATION AND PUBLIC OUTREACH (E/PO) PROGRAM

OSS policy continues to strongly encourage participation by the space science community in education and public outreach activities with the goal of enhancing the Nation's formal education system and contributing to the broad public understanding of science, mathematics, and technology. A significant national program in space science education and outreach is now underway, and OSS's demonstrated contributions to education and outreach have now become an important part of the broader justification for the public support of space science (for further details open "*Education and Public Outreach*" on the OSS homepage at http://spacescience.nasa.gov).

Since 1998 when it started to offer the opportunity to propose E/PO activities in conjunction with its NRA's, the Office of Space Science has received many constructive comments from

members of the space science community as to how to improve its efforts to involve space scientists in education and public outreach. Based on the experience of the past few years and these comments, OSS is making a number of important changes in procedure this year. In particular, starting with this OSS ROSS-2001 NRA, E/PO proposals will be solicited only from those proposers whose research proposals have been already selected for an award. This change should decrease the overall workload on the space science community, increase the likelihood that more E/PO proposals of merit will be funded, and more effectively encourage successful science proposers to add an E/PO component to their research effort.

Therefore, only those proposers to this NRA who are eventually selected on the basis of the excellence of their research awards will be eligible to propose a supplemental E/PO program in accord with the OSS E/PO policies and guidelines. At the time of the release of this NRA it is anticipated that selected Principal Investigators will have two windows of opportunity to submit an E/PO proposal, either: (i) no later than 45 days after the date of the letter of selection of their parent research proposal, with the anticipation of starting the proposed E/PO activity within the first third of the first year of parent research award; or (ii) no later than 75 days before the yearly anniversary date of their award, with the anticipation of starting the proposed E/PO activity in conjunction with next yearly funding supplement of their multiple year award. In either case, consistent with the past E/PO policies and to ease the burden of NASA's administration of these supplemental awards, the total period of performance of an E/PO award will be restricted to that of its parent research award.

The current description of the underlying strategy and implementation plans for the OSS E/PO program may be found through the menu item *Education and Public Outreach* on the OSS homepage at http://spacescience.nasa.gov. The specific policies and procedures for writing and submitting supplemental E/PO proposals in conjunction with proposals selected through this NRA will be posted no later than the end of July 2001, which will be sufficiently early to allow those selected for the program elements with the earliest proposal due dates (see Table 1 below) to organize and submit an E/PO proposal. Questions and/or comments about this OSS E/PO program are sincerely welcomed and may be directed to Dr. David Bohlin, Research Program Management Division, Code SR, Office of Space Science, NASA Headquarters, Washington, DC 20546-0001 (telephone: 202-358-0880; E-mail: david.bohlin@hq.nasa.gov)

- ITEMS OF SPECIAL IMPORTANCE FOR THIS NRA

(1) Because this ROSS-2001 NRA is being released far in advance of many of the deadlines given in Tables 1 or 2, additional programmatic information for any given entry may develop before proposals are due. If so, such material will be added as an Amendment to this NRA as posted at its NRA Web site no later than 30 days before the proposal deadline. Although NASA OSS will also send an electronic alert of any such amendments to all subscribers of its electronic notification system (see Special Note (3) below), it is the

responsibility of prospective proposers to check this NRA Web site for updates concerning the program element(s) and/or cluster(s) of interest.

(2) OSS now requires the electronic submission of certain key elements of proposals through the World Wide Web (see below in the Summary Information), and this practice continues with this NRA. While every effort is made to ensure the reliability and ease of accessibility of this Web site, and to maintain a point of contact for assistance via E-mail, difficulty in accessing and/or using this site may arise at any point on the Internet including the user's own equipment. Therefore, prospective proposers are urged to familiarize themselves with this site and to submit the required proposal materials well in advance of the deadline(s) of the program element(s) of interest.

(3) OSS maintains an electronic notification system to alert interested subscribers of the impending release of its research program announcements. Subscription to this service is accomplished through the menu item *Get E-mail Announcements* on the OSS home page at http://spacescience.nasa.gov by following the instructions for *Space Science Research Announcements*. Owing to the increasingly multidisciplinary nature of OSS programs, this electronic service will notify subscribers of all future NASA OSS program announcements regardless of its type and objective (10 to 15 per year). Regardless of whether this service is subscribed to or not, all OSS research announcements may be accessed from the Web as soon as they are posted (about 8:30 a.m. Eastern Time on the day of release) through *Research Opportunities and Data* on the OSS homepage.

- SUMMARY INFORMATION APPLICABLE TO THIS NRA

- Program alphanumeric identifier: NRA 01-OSS-01

- Date of NRA issue: January 26, 2001

- Guidance for preparation and submission of proposals:

  "*OSS Guidebook for Proposers – 2001*" at URL
  http://spacescience.nasa.gov/research/ossguidebook/

- Submission of *Notice of Intent* (NOI) to propose:

  - Due date: See Table 1 or 2 below for program element of interest (typically 60 days prior to the Proposal Deadline)

  - Web site for electronic submission: http://props.oss.hq.nasa.gov (contact for help: deb.tripp@hq.nasa.gov)

- Electronic submission of the proposal's *Cover Page/Proposal Summary*:

  - Deadline: See Table 1 or 2 below for program element of interest.

  - Web site for electronic submission: http://props.oss.hq.nasa.gov (open for submissions starting about 45 days in advance of proposal due date for each program element; (contact for help: deb.tripp@hq.nasa.gov)

- Web site for download of proposal *Budget Summary* form:

  http://props.oss.hq.nasa.gov
  (contact for help: deb.tripp@hq.nasa.gov)

- Submission of hard copy of proposals:

  - Page limits: Default values are given in Section 2.3 of "*OSS Guidebook – 2001*" (unless otherwise specified in Appendix A of this NRA).

  - Required number: Signed original plus 15 copies (unless otherwise specified in Appendix A of this NRA).

  - Deadlines: 5 p.m. Eastern Time on dates in Table 1 or 2 below.

- Address for submission by US Postal Service, commercial delivery, or courier:

Name of Program Element
ROSS-2001 NRA
NASA Peer Review Services
Suite 200
500 E Street, SW
Washington, DC 20024
Telephone: (202) 479-9030

- Selecting Official: Director or Deputy Director
  Research Program Management Division
  Office of Space Science

- Announcement of selections: Goal: 150 days after proposal due date.

- Initiation of funding for new awards: Goal: 46 days after proposal selection.

- Further information:

  - Specific science program elements: Discipline Scientist listed for each program element in Appendix A.

  - General NRA policies and procedures: Dr. David Bohlin
    Research Program Management Division
    Code SR
    Office of Space Science
    National Aeronautics and Space Administration
    Washington, DC 20546-0001
    Phone: (202) 358-0880
    E-mail: david.bohlin@hq.nasa.gov

Your interest and cooperation in responding to this ROSS-2001 NRA are appreciated. Comments about the inclusive nature and/or structure of this NRA for the OSS supporting research and analysis programs are welcome and may be directed to either the Discipline Scientists identified for each program element in Appendix A or to the point of contact for General NRA Procedures identified above.

Alan N. Bunner
Science Program Director
Structure and Evolution of the Universe

Jay Bergstralh
Acting Science Program Director
Solar System Exploration

Anne L. Kinney
Science Program Director
Astronomical Search for Origins
and Planetary Systems

George L. Withbroe
Science Program Director
The Sun-Earth Connection

APPENDIX A. DESCRIPTION OF PROGRAM OPPORTUNITY Page

TABLE 1

SCIENCE PROGRAM ELEMENTS SOLICITED IN THE ROSS-2001 NRA
(in order of the proposal due dates)

Cluster	NRA Appendix	Science Program Element (see Appendix A)	NOI Due Date	Proposal Due Date	Relevant OSS Science Themes [1]			
					ASO	SEU	ESS	SEC
A.8	A .8.1	X-ray and Gamma-ray Astrophysics	2/23/01	4/06/01		X		
A.8	A.8.2	Cosmic Ray Astrophysics	2/23/01	4/06/01		X		
A.1	A.1.2	Sun-Earth Connection Guest Investigator	2/23/01	4/20/01				X
A.5	A.5.3	Planetary Atmospheres [2]	2/23/01	4/20/01			X	
A.5	A.5.4	Planetary Suborbital Research	2/13/01	4/20/01			X	
A.1	A.1.1	Sun-Earth Connection Theory	3/02/01	4/27/01				X
A.1	A.1.4	Astrophysics Data	3/02/01	5/04/01	X	X	X	
A.1	A.1.5	Long-Term Space Astrophysics	3/02/01	5/04/01	X	X	X	
A.4	A.4.2	Planetary Geology and Geophysics [2]	3/09/01	5/10/01			X	
A.4	A.4.1	Cosmochemistry [2]	3/23/01	5/18/01	X		X	
A.4	A.4.3	Origins of Solar Systems	3/30/01	6/01/01	X		X	
A.5	A.5.1	Planetary Astronomy [2]	4/13/01	6/15/01	X		X	
A.5	A.5.2	Near Earth Object Observations	4/13/01	6/15/01	X		X	

A.7	A.7	Space Astrophysics Research and Analysis [3]	4/06/01	6/21/01	X	X		
A.3	A.3	Geospace Sciences [4]	5/02/01	6/22/01			X	X
A.1	A.1.6	Astrophysics Theory	5/25/01	7/20/01	X	X		
A.6	A.6.1	Exobiology [2]	6/08/01	8/03/01	X		X	
A.6	A.6.2	Planetary Instrument Definition and Development	6/07/01	8/08/01			X	
A.2	A.2	Solar and Heliospheric Physics	6/22/01	8/24/01				X
A.4	A.4.4	Mars Data Analysis	7/06/01	8/31/01			X	
A.1	A.1.3	Living With a Star Targeted Research and Technology	7/18/01	9/19/01				X
A.9	A.9.1	Applied Information Systems Research	7/27/01	9/26/01	X	X	X	X
A.5	A.6.4	Astrobiology Science and Technology	9/14/01	11/09/01	X		X	
A.6	A.6.3	Planetary Major Equipment [2]	See ESS Element of	Program interest. [2]	X		X	
A.5	A.4.5	Discovery Sample Return Lab. Instruments and Data Analysis	TBD	TBD	X		X	

[1] ASO: Astronomical Search for Origins; SEU: Structure and Evolution of the Universe; ESS: Solar System Exploration; SEC: The Sun-Earth Connection.
[2] The proposals for Planetary Major Equipment program element A.6.3 may be submitted in conjunction with program elements A.4.1: Cosmochemistry; A.4.2: Planetary Geology and Geophysics; A.5.1: Planetary Astronomy; A.5.3: Planetary Atmospheres; and A.6.1 Exobiology.
[3] The Space Astrophysics Research and Analysis cluster includes the following program elements that were separately identified in the ROSS-1998 and -1999 NRA's: Ultraviolet, Visible, and Gravitational Astrophysics; Infrared/Submillimeter/Radio/Interferometry Astronomy; Space Astrophysics Detectors; and Astrophysics Suborbital.
[4] The Geospace Sciences cluster includes the following program elements that were separately identified in previous ROSS-1998 and -1999 NRA's: Ionospheric, Thermospheric, and Mesospheric (ITM) Physics; Magnetosphere Physics; and Magnetospheric and ITM Low Cost Access to Space.

TABLE 2

SCIENCE PROGRAM ELEMENTS SOLICITED IN THE ROSS-2001 NRA
(in order of NRA Table of Contents)

Cluster	NRA Appendix	Science Program Element (see Appendix A)	NOI Due Date	Proposal Due Date	Relevant OSS Science Themes [1]			
					ASO	SEU	ESS	SEC
A.1	A.1.1	Sun-Earth Connection Theory	3/02/01	4/27/01				X
A.1	A.1.2	Sun-Earth Connection Guest Investigator	2/23/01	4/20/01				X
A.1	A.1.3	Living With a Star Targeted Research and Technology	7/18/01	9/19/01				X
A.1	A.1.4	Astrophysics Data	3/02/01	5/04/01	X	X	X	
A.1	A.1.5	Long-Term Space Astrophysics	3/02/01	5/04/01	X	X	X	
A.1	A.1.6	Astrophysics Theory	5/25/01	7/20/01	X	X		
A.2	A.2	Solar and Heliospheric Physics	6/22/01	8/24/01				X
A.3	A.3	Geospace Sciences [4]	5/02/01	6/22/01			X	X
A.4	A.4.1	Cosmochemistry [2]	3/23/01	5/18/01	X		X	
A.4	A.4.2	Planetary Geology and Geophysics [2]	3/09/01	5/10/01			X	
A.4	A.4.3	Origins of Solar Systems	3/30/01	6/01/01	X		X	
A.4	A.4.4	Mars Data Analysis	7/06/01	8/31/01			X	
A.5	A.4.5	Discovery Sample Return Lab. Instruments and Data Analysis	TBD	TBD	X		X	

A.5	A.5.1	Planetary Astronomy [2]	4/13/01	6/15/01	X		X	
A.5	A.5.2	Near Earth Object Observations	4/13/01	6/15/01	X		X	
A.5	A.5.3	Planetary Atmospheres [2]	2/23/01	4/20/01			X	
A.5	A.5.4	Planetary Suborbital Research	2/13/01	4/20/01			X	
A.6	A.6.1	Exobiology [2]	6/08/01	8/03/01	X		X	
A.6	A.6.2	Planetary Instrument Definition and Development	6/07/01	8/08/01			X	
A.6	A.6.3	Planetary Major Equipment [2]	See ESS Element of	Program interest. [2]	X		X	
A.5	A.6.4	Astrobiology Science and Technology	9/14/01	11/09/01	X		X	
A.7	A.7	Space Astrophysics Research and Analysis [3]	4/06/01	6/21/01	X	X		
A.8	A.8.1	X-ray and Gamma-ray Astrophysics	2/23/01	4/06/01		X		
A.8	A.8.2	Cosmic Ray Astrophysics	2/23/01	4/06/01		X		
A.9	A.9.1	Applied Information Systems Research	7/27/01	9/26/01	X	X	X	X

[1] ASO: Astronomical Search for Origins; SEU: Structure and Evolution of the Universe; ESS: Solar System Exploration; SEC: The Sun-Earth Connection.
[2] The proposals for Planetary Major Equipment program element A.6.3 may be submitted in conjunction with program elements A.4.1: Cosmochemistry; A.4.2: Planetary Geology and Geophysics; A.5.1: Planetary Astronomy; A.5.3: Planetary Atmospheres; and A.6.1 Exobiology.
[3] The Space Astrophysics Research and Analysis cluster includes the following program elements that were separately identified in the ROSS-1998 and -1999 NRA's: Ultraviolet, Visible, and Gravitational Astrophysics; Infrared/Submillimeter/Radio/Interferometry Astronomy; Space Astrophysics Detectors; and Astrophysics Suborbital.
[4] The Geospace Sciences cluster includes the following program elements that were separately identified in previous ROSS-1998 and -1999 NRA's: Ionospheric, Thermospheric, and Mesospheric (ITM) Physics; Magnetosphere Physics; and Magnetospheric and ITM Low Cost Access to Space.